

REMARKS

Claims 1, 3-15, and 17-20 are pending in the application, with claims 1, 8 and 15 being the independent claims. Claims 8, 17 and 18 are currently amended.

Applicant respectfully traverses the Examiner's rejection of each independent and dependent claim pending in the application.

Objections to the Claims

Claims 17 and 18 are objected to because of informalities. Claims 17 and 18 have been amended to depend on claim 15, as suggested in the Action. Applicant respectfully requests the objections to claims 17 and 18 be withdrawn.

Rejections under 35 U.S.C. § 101

Claims 8-20 are rejected under 35 U.S.C. 101 for being directed to non-statutory subject matter. Applicant respectfully traverses the rejections.

Claim 8 has been amended to recite in part:

at least one hardware processor;

The at least one hardware processor and computer readable memory together comprise a system. While it may be possible to run a first and a second virtual machine on an abstraction of a processor, i.e., within a third virtual machine, eventually all of the instructions for the first and second virtual machine will be executed by a hardware processor. Execution of program instructions requires a hardware processor. Regardless of the number of virtual machines running within virtual machines, at least one of the virtual machines must be running on at least one hardware processor, which must execute all program instructions required for the operation of all of the virtual machines. Therefore, claim 8 recites a statutory system including at least one hardware processor.

Claim 8 has also been amended to recite, in part:

update a page table in a processor by placing a page associated with the first virtual machine in an address space associated with the second virtual machine.

The tangible results of claim 8 are the same as the tangible results of claim 1. Claim 1 has not been rejected under 35 USC 101, and therefore is assumed to produce tangible results. In both cases, the tangible results are the updating of the page table through the placing of a page associated with the first virtual machine in an address space associated with a virtual machine. Before using the method recited in claim 8, the second virtual machine cannot access the data stored in the memory comprising the page associated with the first virtual machine. After using the method of claim 8, the computer readable memory in which the page table resides is modified by the virtual machine monitor, and the second virtual machine is allowed access to the data stored in the memory comprising the page associated with the first virtual machine. Hence, the tangible results are the changes to the computer readable memory in which the page table resides and the ability of the second virtual machine to access data stored in the memory comprising the page table associated with the first virtual machine.

Claims 9-14 are allowable over the rejection for being directed to non-statutory subject matter for at least being dependent on claim 1.

Claim 15 was rejected for being directed to non-statutory subject matter. The Action states, in part: "The claimed product, a computer readable memory, could be constructed of software program instructions. Thus, this claimed product could be a virtual memory address space that is software containing machine-executable instructions, per se (and not associated with any physical structure)" (Action, pages 2-3). The claimed product of claim 15 is "a computer readable memory containing program instructions." Even if the computer readable memory is part of a virtual memory address space, the computer readable memory itself is still a physical structure. A virtual memory address space is a software construct that controls access to physical memory by virtual machine processes running on the system. The computer readable memory must still be a physical

piece of hardware, as data, including program instructions, cannot be stored without hardware. It is possible for a first virtual address space to contain software program instructions defining a second virtual address space within the first virtual address space (i.e., in the case of a second virtual machine running inside of a first virtual machine.) However, even in this case the computer readable memory of claim 15 must still be hardware, as the second virtual machine's virtual address space will be mapped to some portion of the first virtual machine's address space, which is itself mapped to the hardware of the computer readable memory. Therefore, claim 15 recites a statutory product.

The tangible results of claim 15 are the same as the tangible results of claim 1. Claim 1 has not been rejected under 35 USC 101, and therefore is assumed to have been found to produce tangible results. In both cases, the tangible results are the updating of the page table through the placing of a page associated with the first virtual machine in an address space associated with a virtual machine. Before using the method recited in claim 15, the second virtual machine cannot access the data stored in the memory comprising the page associated with the first virtual machine. After using the method of claim 15, the computer readable memory in which the page table resides is modified according to the program instructions in the computer readable memory, and the second virtual machine is allowed access to the data stored in the memory comprising the page associated with the first virtual machine. Hence, the tangible results are the changes to the computer readable memory in which the page table resides and the ability of the second virtual machine to access data stored in the memory comprising the page table associated with the first virtual machine.

Claims 16-20 are allowable over the rejection for being directed to non-statutory subject matter for at least being dependent on claim 15.

Rejections under 35 U.S.C. § 102

Claims 1, 3-7, 9-14, and 17-20 are rejected under 35 U.S.C. 102 as being anticipated by US Publication No. 20050076156 (Lowell). Applicant respectfully traverses these rejections.

Lowell does not disclose or suggest utilizing first and second virtual machine queues associated with respective first and second virtual machines to communicate between the virtual machines.

Lowell appears to suggest the use of a virtual memory monitor to manage the way in which the machine memory (which is the actual hardware memory) of the machine on which the virtual machines are run is divided up among various virtual machines (Lowell, abstract, paras. 26-28). The virtual machine monitor is responsible for virtualizing memory at the run time of the one or more virtual machines, and devirtualizing memory when it is no longer necessary for memory to be virtualized (Lowell, para. 24). The virtual machine monitor also appears to be responsible for reassigning machine memory pages between virtual machines through the remapping of the virtual machines physical memory pages (Lowell, para. 28). A page of machine memory in use by one virtual machine may be reclaimed from that virtual machine by writing the contents of the physical memory page mapped to the machine memory page to disk, and then remapping the physical memory page away from the machine memory page. The machine memory page may then have a physical memory page from a different virtual machine mapped to it.

Lowell does not teach or suggest any method for communication between virtual machines, nor does it utilize virtual machine queues in any manner. The virtual machine monitor of Lowell is designed for purposes wholly different from that of communication between virtual machines. The virtual machine monitor of Lowell appears to be tasked only with managing memory allocation among various virtual machines, including virtualization and devirtualization of memory as necessary based on the number of virtual machines currently running. Nowhere does Lowell disclose or suggest communication between virtual machines, either directly or through the virtual machine monitor. Additionally, Lowell does not disclose or suggest virtual machine queues associated with virtual machines. Nowhere in Lowell is there any mention of virtual machine queues or any equivalent or comparable structure. Because Lowell is directed to memory management, and not communication between virtual machines, there is no need for virtual machine queues in Lowell. The virtual machine monitor can manage memory without virtual machine queues, since the virtual machine monitor only needs to intercept memory requests from virtual

machines to ensure that each virtual machine has access to the right amount of machine memory and does not access machine memory belonging to other virtual machines. This is wholly different from utilizing first and second virtual machine queues associated with respective first and second virtual machines to communicate between the virtual machines.

Further, Lowell does not teach or suggest updating a page table in a processor by placing a page associated with the first virtual machine in an address space associated with the second virtual machine. When the virtual machine monitor of Lowell reassigns machine memory pages between first and second virtual machines, the machine memory page is disassociated from the physical memory page belonging to the first virtual machine, and then associated with a physical page belonging to the second virtual machine (Lowell, para. 28). The process of disassociation involves writing the contents of the physical memory page of the first virtual machine, which are stored in the machine memory page, to a memory page that is on disk instead of in machine memory. The machine memory page may then be reassigned to a physical memory page from the second virtual machine. The virtual memory monitor of Lowell only reassigns machine memory pages between virtual machines. This is wholly different from the technique of claim 1, where a page associated with a first virtual machine is placed in the address space of a second virtual machine. The page associated with the first virtual machine may not necessarily be a machine memory page, as it may be a virtual page that has been paged out to disk. The page table of the second virtual machine is updated so that an address in the memory space of the second virtual machine points to the page associated with the first virtual machine, whether that page is in machine memory or on disk. If the page associated with the first virtual machine is in machine memory, it does not necessarily get paged to disk first, as the machine memory page in Lowell does. If the page associated with the first virtual machine has already been paged to disk, the address space of the second virtual machine may be updated to point to the page's address in virtual memory without requiring the page to be moved into machine memory first. Lowell may only reassign machine memory pages between virtual machines, paging the contents out to disk before reassignment, and may not reassign virtual memory pages that do not have corresponding machine memory pages.

For the above reasons, claim 1 is allowable over Lowell.

Claims 3-7 are allowable over Lowell for at least being dependent on the allowable claim 1.

The action contains no description of a rejection under 35 USC 102(e) for independent claims 8 and 15, although claims 8 and 15 are listed as being rejected under that statute for being anticipated by Lowell on page 4 of the Action. Applicant submits that claim 8 and 15 are allowable, and respectfully requests clarification of the rejection contained in the Action.

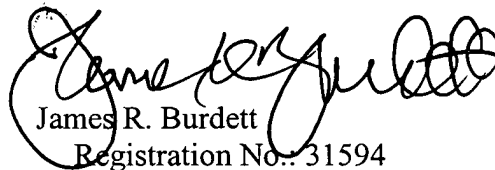
Claims 9-14 and 17-20 are allowable for at least depending on claims 8 and 15, respectively.

Conclusion

All of the stated grounds of rejection have been properly traversed. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is hereby invited to telephone the undersigned at the number provided.

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Respectfully submitted,



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